# DREDGED MATERIAL MANAGEMENT IN NEW JERSEY: A MULTIFACETED APPROACH FOR MEETING STATEWIDE DREDGING NEEDS IN THE 21ST CENTURY

F.M. McDonough, G.A. Boehm, and W.S. Douglas

## ABSTRACT

New Jersey is a maritime state with 76 ports and terminals along its coastline. Dredging and environmentally safe disposal of dredged sediments has been set forth in State policy and provides New Jersey Maritime Resources (NJMR) with the flexibility to manage dredged materials on a case-by-case basis in a comprehensive matrix of primarily beneficial and environmentally sound uses. Traditional management options such as ocean disposal are no longer available. This paper provides a review of overall management strategy and recent innovative dredging projects, including aquatic confinement, upland containment, and brownfield remediation.

New Jersey projects include the Newark Bay Confined Disposal Facility (CDF), coal-mine reclamation, ocean remediation at the Historic Area Remediation Site (HARS), landfill and brownfield remediation in Elizabeth and Kearny, beach replenishment in Cape May and the construction of roadway embankments. Based on an anticipated volume of 7.8 million cubic yards of contaminated material from the Port of New York and New Jersey deepening projects plus 2 million cubic yards from non-deepening projects until the year 2002, NJMR management projects have a remaining project capacity of approximately 14 million cubic yards. An anticipated volume of 6 million (non-contaminated) cubic yards annually from State navigation channels will be managed under a new Statewide Dredging Plan that was approved by the State's Dredging Projects Facilitation Task Force.

NJMR has identified future dredged materials management options utilizing a geographic information system (GIS). Additionally, NJMR has also begun to address sedimentation rates and toxic discharges to New Jersey's waterways through innovative technologies such as AirGuard™, Scour™, in-situ and whole sediment decontamination, and a State Toxics Trackdown and Reduction Workplan.

Keywords: beneficial use, remediation, innovative technologies, sediment, disposal

## INTRODUCTION

In 1637 the King of England declared the first port of entry in the British Colonies. The port was located in a small New Jersey community along the Delaware River called Salem. Since then, New Jersey as a maritime state has continued to be a major port of call from Trenton on the Delaware to Hoboken on the Hudson. While passenger ships no longer steam to New Jersey's 76 terminals, the State serves an import and export cargo industry valued in the tens of billions of dollars.

In the third largest port in the United States, the Port of New York and New Jersey, 85% of the commerce occurs in New Jersey waters (where containerization was invented) and more than 30 billion gallons of petroleum products transit the Port every year. Along the 127 miles of coastline, with its 116 State navigation channels, the fifth largest commercial fishing industry on the East Coast serves America and the world with finfish and shellfish harvests valued in excess of $1 billion annually.

The Delaware River channel reaches 106 miles from the ocean to the largest freshwater port in the world, the combined ports of Philadelphia and Camden. The River serves the second largest petroleum center in the country at 10 terminal facilities and refineries. Three thousand vessels annually ply the river carrying steel, fruit, lumber, fresh meat, and other products.

Maintaining these channels has always been a tremendous challenge for the State of New Jersey. In New York Harbor alone there are 240 miles of Federal navigation channels. In the late 1800's when the sailing ships of the time began to exceed the natural depth of the harbor (18 feet), *The New York Times* called for immediate dredging. In the 1990's, much the same cry was heard as the results of more sensitive testing methodologies determined that much of the dredged material in the Harbor could not be disposed of in the ocean. Compounding the situation, adequate funding was not available for dredging and disposal. The general population no longer appreciates its ports as it did in the early part of the century. Having moved to the suburbs and left the shoreside cities and ports behind, the average citizen has forgotten how the imported cars, fruit, cocoa, wine and beer arrives on our shores.

Finally, it was the New York Harbor dredging crisis in 1993 which galvanized the citizens and their political leaders into action to protect our waterborne transportation and maintain our navigation channels. Dredging and environmentally safe management of dredged materials has since been set forth in State policy and legislation. Traditional management options, such as ocean disposal, are no longer available or extremely limited. Highly flexible policies have been designed to manage dredged materials in a comprehensive matrix of beneficial and environmentally sound uses. This paper examines innovative dredging projects, technologies, and planning currently employed in New Jersey.

## THE CONTAMINANT CHALLENGE

New Jersey sits on a geological shelf which stretches out 32 miles beyond the shore before dropping off into the Atlantic. Its major ports, the Port of New York and New Jersey, and the Ports of Philadelphia and Camden are riverine ports subject to substantial siltation. The Delaware River which leads into the Ports of Philadelphia and Camden, and numerous other ports and terminals along the river's edge, is essentially shallow water scoured only by its own movement and the dredges which travel from Trenton to the ocean. The Port of New York and New Jersey has an average depth of 18 feet and is located on an estuary fed by the Hudson, the Hackensack, the Passaic, the East River and numerous other watercourses which fill the estuary with one million metric tons of silt each year.

Dredging our channels is a never-ending task. We are an industrial region and the sediments as the natural sink for industrial pollutants, bear the legacy of the inadequate waste management practices of the past.

On the New Jersey side of the Port of New York and New Jersey, we face the challenge of the removal of approximately 1.82 million cubic yards of contaminated material annually. Historically, the management method of preference was ocean disposal. For almost 80 years the Port of New York and New Jersey primarily disposed of dredged material by transporting it to an ocean disposal site about six miles off the New Jersey coast. Known as the Mud Dump Site, this was one of more than a dozen ocean disposal sites for various materials from the metropolitan area. However, improved laboratory technologies and analysis of an increased number of contaminants revealed that much of the material being transported to the Mud Dump Site created the distinct possibility of biological uptake in the aquatic animals that subsisted, habitated in, and passed through the Mud Dump region, an area of almost 23 square miles.

In 1993 the fishing and environmental communities brought this practice to a halt in a lawsuit which challenged ocean disposal of contaminated dredged materials. Ultimately, the Federal government closed the Mud Dump Site forever and created, in its place, a remediation site which coincided with all the original disposal areas called the Historic Area Remediation Site (HARS).

Fortunately, the Governor was well ahead of this and had decided early on to adopt the policy of beneficial upland use for dredged materials. To meet this goal she directed a number of independent but interrelated actions. In 1994, while the lawsuit wound its way through the courts, newly-elected Governor Christine Todd Whitman created a team to develop short-term non-ocean alternatives while a fully comprehensive approach to dredged materials management was crafted. The result was implementation of a short-term disposal option (a subaqueous confined disposal facility in Newark Bay) and creation of a complex management strategy employing high and low technology options managed by a highly directed team of professionals within State government. This is the multifaceted management system which will resolve disposal challenges for the 21$^{st}$ century.

## THE APPROACH

The Governor tasked her Commissioner of Environmental Protection to draft a single regulatory document which would provide for the environmentally safe management of all dredged materials. To write *The Management and Regulation of Dredging Activities and Dredged Materials in New Jersey's Tidal Waters*, commonly called the "Technical Guidance Manual", a highly skilled Task Force of two dozen experts from every technical field within the Department of Environmental Protection worked for more than a year. The manual divided the State into several zones based on the types of dredged materials involved and the potential levels of contaminants. The document sets testing criteria, sampling requirements, and upland management protocols.

The Governor then created New Jersey Maritime Resources in the New Jersey Department of Commerce and Economic Development. The mission of the Office is to provide agency support and coordination, programmatic planning, and research and development to ensure sustainable

economic development of New Jersey's $50 billion maritime industry including its ports and terminals, boat building, marine trade services, commercial and recreational fishing, military operations, waterborne transportation, navigation and government services, and education, science and technology.

Funded by a public/private partnership known as Prosperity New Jersey, NJMR immediately set about publishing comprehensive plans for dredging and disposal of dredged materials throughout the State. The Office reached out to its maritime industry constituents to develop a cooperative working relationship and conducted a conference to encourage private sector involvement in developing solutions. More than 230 industry representatives participated and the private sector has been a major factor in our success.

NJMR remains the lead agency in developing dredging programs, new technologies and beneficial use alternatives for dredged materials.

In the meantime, the Governor, working with the Governor of the State of New York, created the necessary funds and a Joint Dredging Plan between the two States which would ensure that initial steps were taken toward the long-term. $130 million was set aside for the two States to utilize in regulatory initiatives, technology development, sediment engineering, processing technologies, beneficial use, contaminant reduction and trackdown, pollution prevention, and harbor studies.

The New Jersey Legislature adopted legislation to create a $185 million bond fund for dredging of the navigation channels in the Port of New York and New Jersey, the development of CDFs, and the demonstration of decontamination technologies. The bill also created a $20 million fund for dredging navigation channels statewide. In November of 1996, the voters approved the Bond Act by a 2 to 1 margin. These funds, in addition to the Joint Plan funds, are managed by New Jersey Maritime Resources.

Then and perhaps most importantly for the permitting process, the Governor, through her Commissioner of Environmental Protection, created a single office within the New Jersey Department of Environmental Protection (NJDEP) to manage permitting of dredging and dredging-related projects. The Office of Dredging and Sediment Technologies combines expertise from a number of different fields to provide comprehensive one-stop review of proposals.

The Office of Dredging and Sediment Technologies, not coincidentally, is located within the NJDEP Site Remediation Program. This provides a fully integrated relationship between dredging and upland beneficial use options for dredged materials including site remediation, landfill capping, and construction fill. No matter what the proposed option: decontamination, manufactured soil, demonstration technologies, etc., this single Office contains the expertise to provide qualified and rapid response. Unlike the typical regulatory response, this Office is willing to step up to the plate and provide pre-application advice to the applicants to ensure that when a project is ultimately submitted, a permit can be promptly issued.

Finally, New Jersey Maritime Resources drafted a Statewide Dredging Plan to manage all dredging and dredged material disposal activities in the State of New Jersey. Mirroring the plans for the Port of New York and New Jersey, the Statewide Dredging Plan reviewed future requirements, developed a priority list for meeting those requirements, and identified options for the disposal of the dredged material utilizing as its guide the new statewide policy for beneficial use.

Unique projects, such as those described in this paper, provided an opportunity for the creation of upland disposal facilities and upland beneficial uses which incorporated local goals and included recreational, environmental, and educational components to ensure that each project had the necessary public support. The Penultimate Act was the endorsement by the Governor of a coalition of business leaders throughout the State of New Jersey to work with the Federal Administration and the Congress to ensure that Federal funding was available for all of the many Federal navigation projects throughout the State.

## THE FUTURE

New Jersey has a tradition of utilizing a number of different methodologies for disposal and beneficial use of dredged materials from State navigation channels and facilities located along the Delaware River. Those management options include beach replenishment, confined disposal facilities, in-water disposal, and more recently, multiple use CDFs. Within the last decade, upland CDFs were even mined to produce soil for fill in construction projects. Dredging of certain channels where the material is both clean and of the correct grain size, has been routinely conducted by private contractors seeking sand for use in the marketplace. However, in certain locales such as the Port of New York and New Jersey a single option--ocean disposal--was relied on almost exclusively.

Because of the seemingly unlimited capacity for disposal in the ocean and the unavailability of other traditional disposal options such as upland CDFs, attempts to develop alternatives to ocean disposal generally failed. It wasn't until the dredging crisis of the early 1990's that real incentive existed to create innovative non-ocean alternatives. While New Jersey has been the leader in the development of those alternatives, the mind-set of many remains a search for the "silver bullet" disposal option.

Yet, political pressure, environmental activism, and the success of the non-ocean alternatives developed by the State of New Jersey are slowly but surely convincing even the diehards that reliance on a single disposal option is a thing of the past. The future is now reflected in a multifaceted approach to sediment management. Prior to 1993 almost 99% of all dredged material from the Port of New York and New Jersey was deposited in the ocean as reflected in Figure 1.

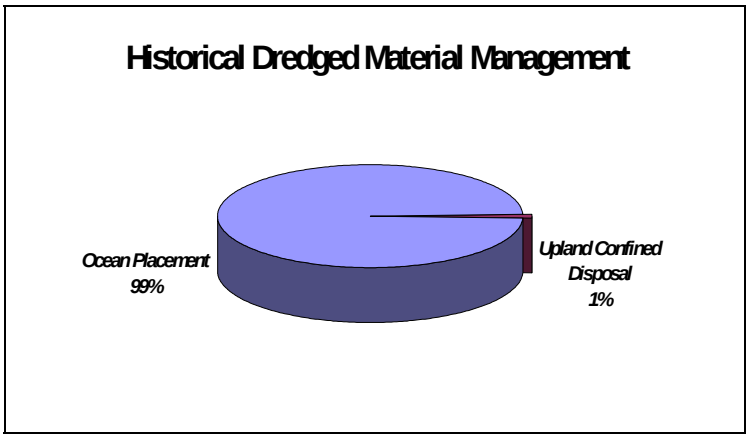



***Figure 1***

The shift to non-ocean alternatives is dramatically reflected in management operations conducted between 1995 and 1998 as shown in Figure 2.

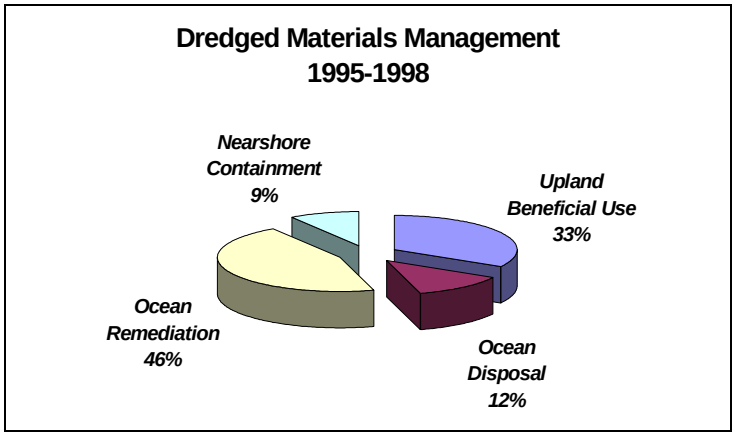



***Figure 2***

As Figure 3 reflects, in 1999 ocean disposal has been completely eliminated in the Port of New York and New Jersey. The only material now destined for the ocean is utilized for HARS remediation and then only after rigorous testing.

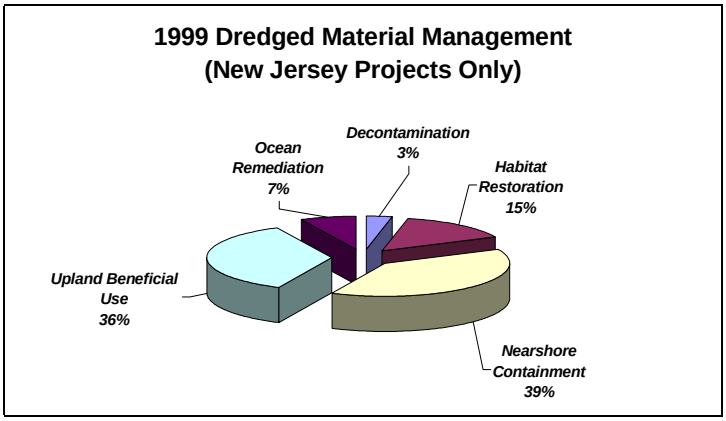



***Figure 3***

## Comprehensive Management

New Jersey's sediment management plan is reflected in Figure 4. This combination of initiatives represents a comprehensive approach to the management of all dredged materials, especially contaminated dredged materials, and a series of initiatives designed to reduce sedimentation and eliminate contamination. The chart reflects strategies that are either already in operation, or in the research and development phase close to implementation. Each is also designed to compliment the other strategies recognizing, again, that no single approach nor even a limited collection of approaches will provide a fully successful management strategy.

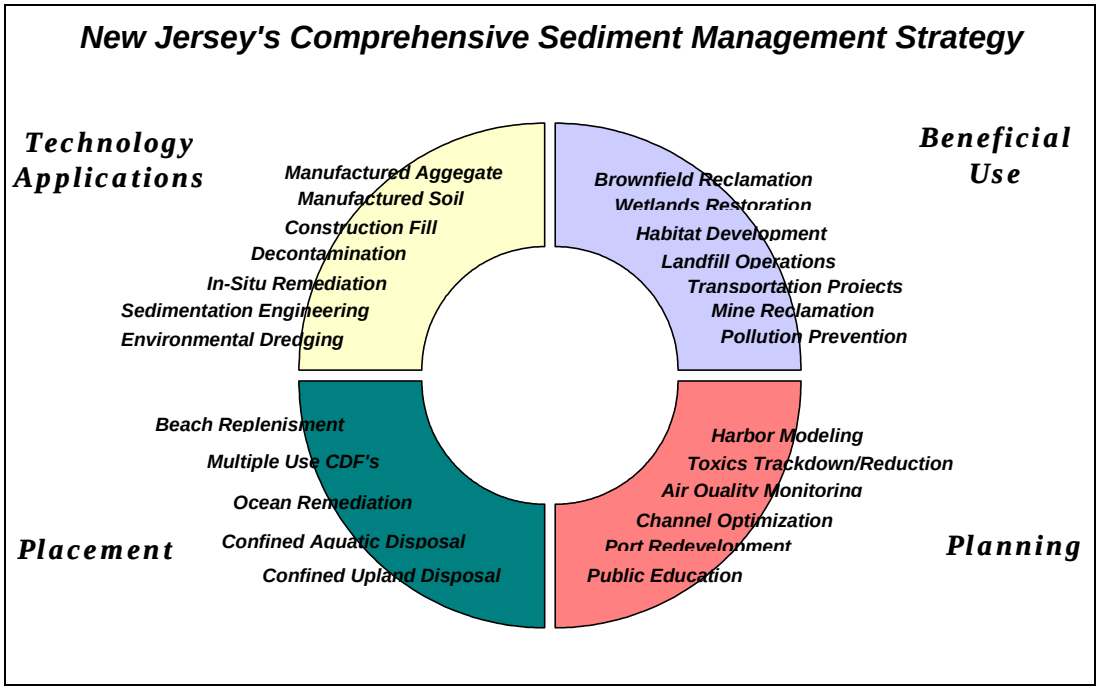



***Figure 4***

While the comprehensive sediment management plan applies statewide, the obvious genesis of the plan is the contaminated sediments found in the Port of New York and New Jersey. Table 1 reflects the types and levels of contaminants found in dredged materials in New York Harbor, particularly in Newark Bay. Comparing the sediment quality in Newark Bay to guidelines for the protection of aquatic life (Effects Range Low, Effects Range Median) one can see why the fishing and environmental community expressed concern over ocean disposal. However, when the same data are compared to the guidelines developed for protecting terrestrial ecosystems and human health (NJ Residential/Non-Residential Clean-up Criteria), it becomes apparent that environmentally sound upland management practices are possible. The techniques utilized can generally be categorized as high technology, low technology, and traditional approaches.

***Table 1***
***Levels of Contaminants in Dredged Materials****

| Chemical | Minimum Conc. | Maximum Conc. | Effects Range Low | Effects Range Median | NJ Residential Cleanup Criteria | NJ Non-Residential Cleanup Criteria |
|---|---|---|---|---|---|---|
| **Antimony (mg/kg)** | 0.20 | 43.9 | Not available | Not available | 14 | 340 |
| **Arsenic (mg/kg)** | 1.2 | 67.4 | 8.2 | 70 | 20 | 20 |
| **Cadmium (mg/kg)** | 0.13 | 29.0 | 1.2 | 9.6 | 1 | 100 |
| **Chromium (mg/kg)** | 6.60 | 860.0 | 81 | 370 | Site Specific | Site Specific |
| **Copper (mg/kg)** | 0.44 | 2470 | 34 | 270 | 660-900 | 660-4000 |
| **Lead (mg/kg)** | 5.60 | 2500 | 46.7 | 218 | 400 | 600 |
| **Mercury (mg/kg)** | 0.10 | 12.4 | 0.15 | 0.71 | 14 | 270 |
| **Nickel (mg/kg)** | 7.10 | 369 | 20.9 | 51.6 | 250 | 2400 |
| **Silver (mg/kg)** | 0.11 | 42.3 | 1.0 | 3.7 | 110 | 4100 |
| **Zinc (mg/kg)** | 20.50 | 1900 | 150 | 410 | 1500 | 1500 |
| **Chlordane (µg/kg)** | 1.04 | 210 | Not available | Not available | Site Specific | Site Specific |
| **Total DDT (µg/kg)** | 3.77 | 1325.7 | 1.58 | 46.1 | 2000 | 9000 |
| **LPAH (µg/kg)** | 131.8 | 1368200 | 552 | 3160 | Site Specific | Site Specific |
| **HPAH (µg/kg)** | 668 | 1115000 | 1700 | 9600 | Site Specific | Site Specific |
| **Sum PCBs (µg/kg)** | 18.76 | 17200 | 22.7 | 180 | Site Specific | Site Specific |
| **2378TCDD (ng/kg)** | 0.20 | 13500 | Not available | Not available | Site Specific | Site Specific |
| **2378TCDF (ng/kg)** | 0.31 | 480 | Not available | Not available | Site Specific | Site Specific |

*Analysis conducted of Newark Bay samples by NJ Maritime Resources

## High Technology

High technology initiatives include employment of techniques which will reduce or eliminate sedimentation in the navigation channels and berths, decontamination technologies which remove the contaminants from the excavated dredged materials, in-situ remediation technologies, the Toxics Trackdown Plan being executed by the New Jersey Department of Environmental Protection, air quality monitoring programs to ensure that all of our upland beneficial use projects meet human health and environmental standards, and harbor modeling which will allow us to better understand the dynamics of our Harbor.

## Low Technology

Low technology projects include the processing and use of contaminated and non-contaminated dredged materials for landfill operations and closure, hazardous site remediation projects which utilize both clean and contaminated dredged materials for capping, transportation projects in

which dredged materials are processed to create manufactured soil for berms, grading, and fill, and the Pennsylvania Mines Reclamation Project which utilizes processed dredged materials to reclaim strip mines in Pennsylvania while reducing and eliminating acid leachate from those mines.

A full description of each of the technologies currently being employed or about to be employed in New Jersey is contained in Appendix 1.

**Traditional Approaches**

Traditional projects utilize clean dredged materials for remediation of the former ocean disposal site, removal of dredged materials from the Harbor in an environmental dredging program, utilization of in-water CDFs for placement of contaminated dredged materials, and the use of existing upland dredged material disposal facilities for multi-use projects.

**Beneficial Use of Contaminated Material**

While upland CDFs are available in other parts of the State of New Jersey, no such facilities exist in the Port of New York and New Jersey. Redevelopment of brownfields and proper closure of landfills presented the most obvious opportunities for beneficial use of dredged materials. The first priority for the Port was to develop upland beneficial uses for dredged materials in construction, site remediation and landfill operations. However, the negative public perception created by significant media attention to contaminated dredged materials in New York Harbor resulted in an immediate obstacle to general use of dredged materials for beneficial purposes. This is true even though some of the contaminated dredged materials would meet the residential clean-up standards in the State of New Jersey, and all dredged materials would meet most non-residential site clean-up criteria. Regardless, a formula was needed which would provide the necessary public confidence that contaminated dredged materials would not be found in "my backyard."

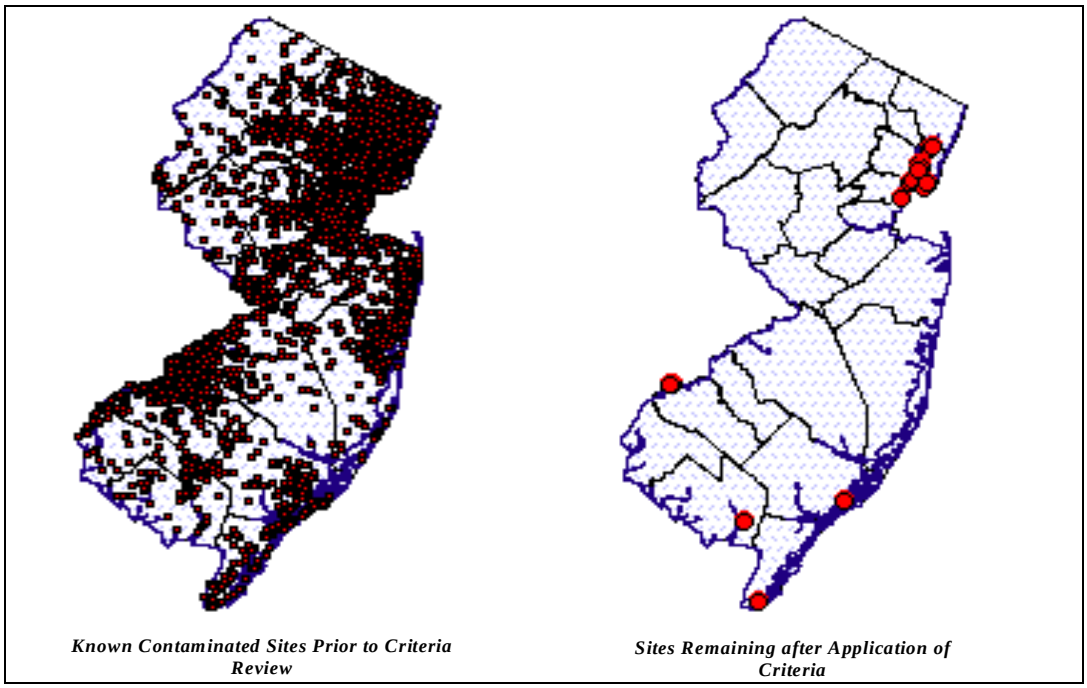
The "formula" for beneficial use of dredged materials took the form of a list of criteria, established by combining both practical considerations and the Governor's policy against use of dredged materials near residential areas. Sites were plotted and, utilizing predicted volumes of contaminated and non-contaminated dredged materials proposed for dredging over an eight year period in the Port of New York and New Jersey, NJMR staff were able to identify sufficient capacity to satisfy disposal requirements. These sites for placement of dredged materials had to be close enough to waterways and roadways to allow cost effective access, yet far enough from schools, houses of worship, and residential areas to provide a buffer. The best sites were determined to be those that had previously been industrialized (brownfields) or solid waste landfills. Only sites greater than 40 acres were considered economically viable.

While development of the formula was relatively straightforward, a list identifying sites meeting these criteria had never been developed. Utilizing the GIS developed by NJDEP, maps of the closed and/or abandoned solid waste landfills and known contaminated sites in New Jersey were made using Arcview software. Inputting coverage of land use, navigable waterways, residential areas and houses of worship allowed NJMR to perform a spatial analysis that resulted in

identification of the sites which would meet strict criteria. The result of this analysis is reflected in Figure 5.

During the time that NJMR was developing a list of viable sites, an unrelated legislative approach was being developed that would encourage redevelopment of brownfield and landfill sites throughout the State. Landfills were typically identified as those which were "orphan" landfills or former landfills where there was insufficient funds to reopen and close them in accordance with current standards. Brownfields were identified as any commercial or industrial site that is currently underutilized and where there has been or suspected to have been, a discharge of a contaminant. Legislative initiatives generally provided for liability protection for those who would remediate, tax incentives for remediation, reimbursement for a portion of clean-up costs, paid innovative clean-ups, protection from third party claims, and lessor/successor protection. This legislation provided the protections necessary for private investors to come forward and propose plans for the use of dredged materials in redevelopment projects.

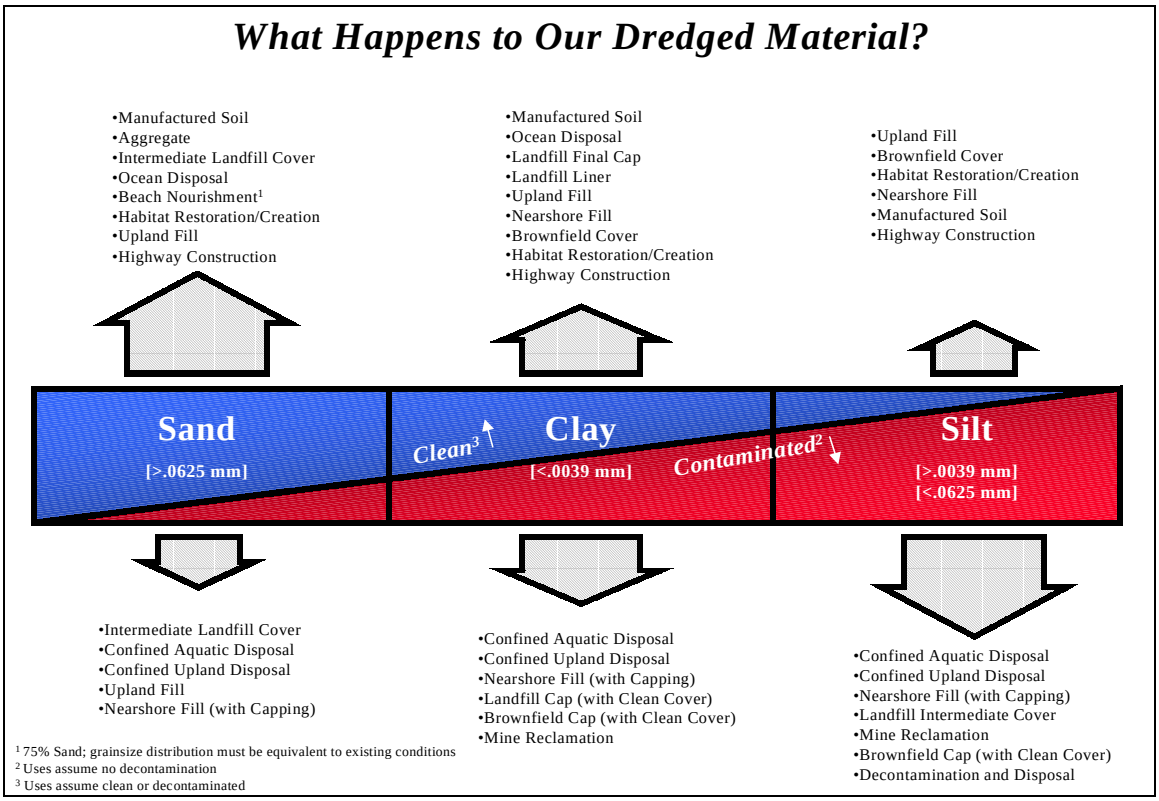
Another effort undertaken by NJMR was the development of a database of dredging projects throughout the State, and the annual projected volume of dredged materials that would require management. Information on capacity available at dredged materials management areas was also added to the database. This database, integrated with the spatial analysis performed using GIS, allowed NJMR to demonstrate available capacity for all dredged materials in the Harbor through 2005, with ample new sites for additional capacity which may be explored both publicly and privately.




***Application of GIS for Screening Known Contaminated Sites List***
***Figure 5***

## Processing Facilities

While the private sector stepped up to the plate to develop beneficial use of dredged materials for upland activities, New Jersey continued to refine the potential uses for dredged materials as shown in Figure 6.

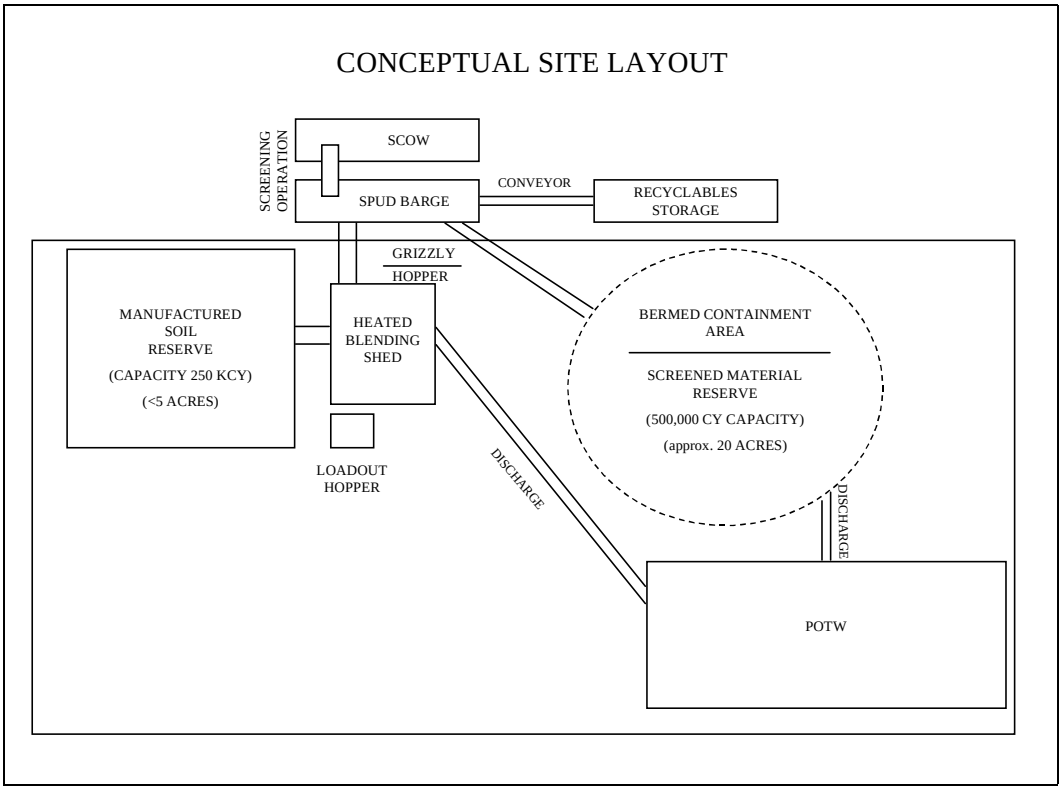



***What Happens to Our Dredged Materials?***
***Prepared by NJ Maritime Resources***
***Figure 6***

But the handling of dredged material proved to be a unique challenge. For example, dredged material from New York Harbor is 65% water, contains a high level of nutrients and is, of course, saline. It is not hard to picture the difficulty of dealing with sloppy, wet material in the payload bed of a truck or a rail gondola car. Moreover, environmental windows, which prevented dredging during certain fish habitat and migration times, made it difficult to develop a steady stream of dredged materials for various upland projects. This presented challenges to the private sector which needed that flow to profit. Furthermore, dredged materials in marinas and at terminals included large amounts of debris such as scrap metal, logs, pilings, and other objects which made the handling of the silt extremely difficult and expensive. Initially, the private sector tried pumping the dredged material over long distances to the site being reclaimed, then mixing the dredged material with admixtures to stabilize and create the necessary compaction rates for the intended use. Tires, bicycles, car doors, and other foreign objects destroyed the pumps in quick order. It is rumored that one private sector entrepreneur initially made more money recycling scrap metal than processing dredged materials.

In the end, new techniques for in-barge screening at dockside became the preferred method for ensuring that the dredged materials went though the process smoothly and expensive equipment was not destroyed by foreign objects. As the private sector learned from its investments, processing facilities became more economical, more efficient and mobile. Now they can be moved from location to location.

However, the State of New Jersey requires a facility which could guarantee processed, stabilized and enhanced dredged material for the landfill, site remediation, and transportation projects it was managing. Thus was born the idea of the State-owned, privately operated processing facility reflected in the design prepared by NJ Maritime Resources in Figure 7. This facility will process, stabilize and blend dredged materials to create manufactured soil at the rate of 500,000 cubic yards per year. The facility includes storage area to ensure that processed dredged material will be available twelve months of the year for ongoing State projects.




***Processing Facility***
***Figure 7***

**Beneficial Use of Clean Dredged Material**

In the Port of New York and New Jersey the United States Army Corps of Engineers, the Port Authority of New York and New Jersey, and the State of New Jersey are currently engaged in several significant deepening projects. The Kill Van Kull, which is the major waterway leading to the terminal facilities located in Port Newark and ElizabethPort, is currently being dredged to 45 feet. The Arthur Kill, which leads to many of the petroleum facilities in New Jersey as well as Port Authority terminals at Howland Hook on Staten Island, is scheduled to be deepened to 41

feet. Port Jersey Channel on the upper New York Bay will be dredged to 41 feet starting this summer, and a study is currently underway to deepen channels to 50 feet.

Collectively, these projects will produce millions of cubic yards of clean dredged material which can be utilized for a number of beneficial purposes. Rock is currently the subject of competition for various artificial reef and shoreline protection programs. Clean silt and sand will be utilized to help restore the Historic Area Remediation Site by capping the contaminated materials which had been deposited for more than 80 years in that 23 square mile area.

The most unique of these projects is the dredging of almost 10 million cubic yards of red/brown clay. This material has a general permeability rating of $10^{-7}$ or $10^{-8}$ making it a perfect capping material for the proper closure of orphan landfills in and around New Jersey's waters. So New Jersey has embarked upon a major demonstration project utilizing red/brown clay to cap abandoned landfills and construct slurry walls, preventing contaminated leachate from running into the Harbor. It is estimated that each improperly closed landfill discharges up to 400,000 gallons of contaminated leachate per acre into the Harbor annually. Thus New Jersey's red/brown clay program will serve several noble purposes: dredging navigation channels, properly closing abandoned landfills, and pollution prevention. The first demonstration project will start this summer and the program is expected to be replicated throughout the State of New Jersey at both abandoned and operating landfills.

The clay can also be utilized to provide a solid cap over the contaminated areas at the HARS and, if the material is not proven to be a good fit for habitat development, it could be further capped with clean dredged materials to provide the necessary habitat.

**Confined Disposal Facilities-Multiple Use**

As noted several times in this report, upland confined disposal facilities are in operation throughout the State of New Jersey. However they are traditional CDFs and they have become the subject of intense local public debate particularly with the deepening of the Delaware River. That project will excavate some 33 million cubic yards over several years and will require the continued use of a number of existing CDFs as well as the construction of new ones. Opposition to many of these facilities has increased in recent years as the fear of exposure to "contaminated materials" has heightened. While this fear may be misplaced regarding the Delaware River Project, New Jersey has developed an extremely active approach to the continued use of its existing facilities as well as the development of new ones.

By creating multiple-use facilities, New Jersey expects to educate individuals on the benefits of dredging through direct use of those confined disposal facilities for other purposes. The Palmyra dredged materials disposal facility on the Delaware River is the premiere example as shown in Figure 8. This unique facility was developed by a partnership of Burlington County officials, the Burlington County Bridge Commission, NJDEP, and others to create a natural habitat, as well as a beneficial use facility for storage and dewatering of dredged materials.


***Palmyra Cove Nature Park MasterPlan***
***Designed by ACT Engineers***
***Figure 8***

Facility plans include boardwalk trails, wildlife observation decks, shore access, fishing facilities, a nature preserve, an environmental education center, an education program on the necessity and benefits of dredging, and picnic areas. Moreover, the dredged materials deposited on this site will be mined for beneficial use projects throughout Southern New Jersey. In fact, materials from this site already have been utilized for construction of the entertainment amphitheater in the City of Camden. All future CDFs will be analyzed for the purpose of developing multiple use benefits for the local citizenry.

In the meantime, New Jersey Maritime Resources has embarked on a multi-faceted education program. Working with the New Jersey State Chamber of Commerce, the New Jersey Business and Industry Association, the New Jersey Alliance for Action, the Regional Business Partnership, the International Longshoremen's Association, the New York Shipping Association,

terminal owners and others, a series of classroom education programs, media initiatives, and public speaking activities have been developed to remind the citizens of the benefits of our maritime industry and to ensure that the information that is provided is accurate and appropriate.

**Planning Initiatives**

Among the recommendations of the Governor's Dredged Materials Management Team, and the provisions of the Bi-State Joint Dredging Plan was the requirement for a careful examination of existing dredging requirements and a concerted effort to minimize those requirements. Currently, in the Port of New York and New Jersey, the US Army Corps of Engineers, the Port Authority of New York and New Jersey and the two States are conducting a Harbor Navigation Study to determine the appropriate depths for the existing channels in the Harbor. While the study is expected to result in the deepening of certain channels, it may also identify those channels which justify only current depths or even reduced maintenance.

New Jersey has also embarked upon an ambitious channel optimization plan which reviews each channel to identify opportunities for redesign which will reduce the amount of construction and maintenance dredging. Even public notices by private applicants for dredging permits are scrutinized closely to identify future dredging requirements and to encourage the development of comprehensive maintenance dredging plans for those facilities.

Probably the most significant study in New York Harbor is the Toxics Reduction Workplan developed by New Jersey to implement the contaminant trackdown and reduction goals of the Harbor Estuary Plan. The purpose of this study is to identify the sources of contaminants of concern to the Harbor and to begin to abate those sources through a toxics reduction strategy of increased monitoring, site cleanup/closure and environmental dredging. While hot spots in surficial sediment chemistry can easily be identified, there is no sound method to predict the overall impact of remediation strategies on the quality of the dredged material. To address this shortcoming, the State of New Jersey, working closely with the State of New York and federal agencies, is developing a state-of-the-art contaminant fate and transport model. This mode will enable managers to predict the outcome of contaminant reduction strategies on the quality of dredged materials in the future. This will ensure that limited funds are utilized most efficiently to achieve the greatest environmental gain.

Commensurate with these studies, is a series of important habitat development/redevelopment and wetlands restoration projects currently under development. Toxics trackdown, natural resources restoration, and pollution prevention are the three legs of the stool that will ultimately result in sediments clean enough for any purpose or disposal methodology.

## CONCLUSION

If any conclusion can be drawn from the multiple disparate efforts identified in this paper, it is that the key to success is political will, creativity, and commitment. The political will is evident in the State's determination to establish the necessary processes which ensure the success of a relatively complex series of initiatives.

Creativity is reflected in the broad scope of technological initiatives now being employed or developed throughout the State. Commitment is reflected in the extremely short period of time within which the State of New Jersey traveled the great distance between no dredging, no disposal, and no funding, to a full and comprehensive dredging regime, funding, and even excess disposal capacity for the near-term.

Also key to New Jersey's success was the decision to entrust economic development issues and environmental protection in the hands of dedicated professionals working in partnership to achieve a common goal.

In the past, dozens of initiatives and years of study, while ably done by highly competent technicians, were characterized by a singular lack of connectivity and leadership. Simply put, there was no single thread connecting them all and the political leadership was not focused on the issue. Crisis created focus and filled in the missing ingredients. Now we are presented with, not only a comprehensive approach, but a coordinated approach and an ability to access and integrate all of the programmatic information that the public and private sectors are developing.

New Jersey's multifaceted approach for meeting statewide dredging needs in the 21st century can be characterized as a program which allows for continued progress even if one or more facets encounter unforeseen obstacles. The remaining elements of the program will continue to sustain our maritime industry while fine-tuning is applied to the faltering segment. Just as dredging is a never-ending task, so too is continuous and diligent attention to every component in the package. The approach developed by Governor Whitman provides precisely that level of management.

## APPENDIX 1

### High Tech Initiatives

- Turbo Jetting – An alternative strategy to dredged materials management is to prevent the settling of particles in berthing areas, thereby reducing or eliminating the need to dredge there. One way to accomplish this is by using a high volume jetting system to agitate the water near the sediment surface periodically, thereby preventing the settling of fine particles. The SCOUR™ system is a high volume, low velocity pump that pulls surface water through a pipe and directs it out across the sediment-water interface. Multiple units are installed in a series across a pierhead, and are turned on for a short period at the start of ebb tide during each tidal cycle. The resulting water flow carries the fine particles deposited during the last slack tide out of the berthing area with the outgoing tide. One such project is currently under development by NJMR.

  Entrainment of fish larvae and sediment resuspension are of concern to regulators regarding this technology. Therefore NJMR has worked extensively with the NJDEP to produce a monitoring plan to determine the impact, if any. Regardless of the outcome, a conceptual cost/benefit analysis will weigh the environmental costs of this technology versus other available management options before a final decision will be made.

- Pneumatic Barriers – A similar strategy sponsored by NJMR employs the use of a series of bubble walls which act to keep particles in suspension, and prevent the buildup of sediments in berthing areas. Air is forced through a series of pipes on the bottom of the berth, oriented to maximize disturbance of water in areas that typically have high deposition. These barriers have already proved effective in floatables control throughout the Harbor, but have not yet been demonstrated to be effective in the control of sedimentation. This system has the added benefit of increasing dissolved oxygen throughout the water column, encouraging aquatic life. Ironically, some operators have expressed concern that attracting aquatic life may result in increased macrofouling of pier structures and water intakes.

- Soil Washing – This decontamination technology is based on the same principles as a washing machine. Sediment is mixed with water in a slurry and agitated in large mixing vessels. Chemicals are added to aid in destruction of organics and dissolution of bonds tying contaminants to the sediment. The “washwater” is then decanted and treated using standard techniques. Clean sediment can then be beneficially used to manufacture topsoil, structural and non-structural fill, and capping/cover material as needed. Two such projects have been selected to participate in the NJMR Sediment Decontamination Demonstration, projected to commence this year. As with all decontamination technologies, extensive public outreach is necessary to ensure that citizen concerns are allayed.

- Thermal Destruction – This decontamination technology relies on high temperature rotary kilns to “bake” the sediments. Organic contaminants are destroyed by the heat and the metals are permanently incorporated into the physical matrix of the sediment. The resulting mineral matrix is then used as a base material for the manufacture of lightweight aggregate or

blended cement. Two such projects have been selected to participate in the NJMR Sediment Decontamination Demonstration, projected to commence this year.

- Enhanced Mineralization – This decontamination technology, known as Georemediation™ enhances the natural process of attenuation of contaminants in sediments and soils. A proprietary mixture of catalysts is mixed with the sediments and allowed to react for up to 28 days. During this time the organic contaminants are broken down into non-hazardous forms and the metals are incorporated permanently into the crystalline matrix. A pilot and demonstration project are scheduled for this year as part of the NJMR Sediment Decontamination Demonstration.

- In-situ Remediation – Due to the potential environmental hazards posed by disturbing highly contaminated sediments in certain locations, the State of New Jersey has been searching for technologies to decontaminate sediments in place. Several techniques have been proposed and are in the bench-scale phase of testing. The most promising uses zero valence iron powder to catalyze the destruction of bonds between the sediments and the contaminants. A series of tubes containing the zero valence iron powder are placed directly into the contaminated sediments. Contaminants are then transferred to the iron powder within the tubes. The tubes are then removed and the highly concentrated pollutants are disposed of appropriately. NJDEP is conducting one such demonstration project that is funded by NJMR.

- Toxics Trackdown – One of the long-range strategies for dredged materials management in the Port depends on the reduction in the amount of dredged materials that require specialized management due to contamination. In order to effectively reduce the amount of contamination being added to the sediments, the sources of those contaminants must be defined and prioritized. The States of New Jersey and New York, working through the Harbor Estuary Program, have developed a cooperative monitoring program to determine the sources and magnitudes of contamination to the water, sediment and biota of the NY/NJ Harbor Estuary. New Jersey's Workplan is being implemented by NJDEP and funded by NJMR.

- Harbor Modeling – In order to develop an effective management strategy for contaminants in the Harbor, a comprehensive fine-scale contaminant fate and transport model must be developed. This model will need to take into account all the point and non-point sources in the Harbor along with the complex hydrodynamics and be able to predict the concentrations of contaminants of concern in water, sediment and biota over a multi-year timeframe. Data collected in the toxics trackdown program may be used to calibrate and validate this complex model. Efforts are underway to develop a Request for Proposals for this project.

- Air Quality Modeling – One of the persistent issues associated with the innovative use of dredged materials in the Harbor region is public perception of risk posed by contamination in the sediments. While individual projects have revealed no human health hazard, an extensive monitoring program is being developed to identify and quantify volatile and semi-volatile pollutants released into the air during dredged materials handling and placement operations. The chosen monitoring site will reference local ambient air quality as a point of comparison.

Fugitive emissions are also being assessed as part of a demonstration project on the use of dredged materials in transportation projects.

**Low Tech Initiatives**

- Landfill Operations – Dredged materials can be used in a variety of ways to facilitate operations at solid waste landfills. Silty dredged materials can be amended with sand, woodchips, or biosolids to create intermediate cover. Alternatively, dredged materials can be mixed with cement-based admixtures to provide fill and capping for closure operations. Other admixtures, including a recycled product made from shredded car interiors (Propat™), are currently under development. Because landfills are required to have leachate collection systems and other engineering and institutional controls, all but the most contaminated materials can be used effectively. Clean dredged material composed of consolidated heavy clays can be used as landfill liner material, as final cap, or in slurry wall construction.

- Site Remediation – One of the most successful uses of dredged materials is in site remediation activities. Contaminated sites frequently have either institutional or engineering controls, rendering them excellent for all but the most contaminated dredged materials. Usually the contamination on site is orders of magnitude greater than the contamination in the dredged material, which results in an immediate improvement in environmental conditions on the site when dredged materials are used. Dredged materials can be combined with admixtures to create engineered structural fill, nonstructural fill, slurry walls, and final cap depending on their physical characteristics.

  The first successful operation of this type, the ORION project in Elizabeth, NJ, proved to be an excellent learning experience for the industry. The issue of material handling was the most troublesome. The contractor had extensive problems with debris and pumping equipment. The eddy pump system originally employed was replaced with conventional bucket dredging. Screening for debris was accomplished by sifting material through a grizzly prior to entering the pugmill. Other issues included permitting and contracting. Due to the unpredictable nature of site remediation projects, public/private partnerships are essential for these projects to progress. The ORION project was successfully completed, a second project is underway in Kearny, NJ, a third site is fully permitted and a fourth project is in the permitting stage.

- Transportation Projects - The State of New Jersey is currently developing the use of dredged materials in transportation projects. A project is underway to develop engineering standards for the use of dredged materials in roadway embankments. Due to the high cost of fill in the metropolitan area, use of amended dredged materials may prove to be highly cost effective. Final topsoil cover and roadway materials will reduce or eliminate any potential for generation of contaminated leachate. Models are being developed to predict environmental impact from the use of dredged materials, if any. An important concern being addressed is variability in admixture ratios in the final product. Dewatering of raw dredged materials may be required to ensure uniformity of engineering properties.

- Beach Replenishment – One of the oldest uses of dredged materials is for nearshore operations. The use of clean sandy dredged materials for beach replenishment is encouraged and will be utilized in the Delaware River Deepening Project as well as a small beach and dune project in South Jersey being funded by NJMR. Replenished beaches are not only attractive to tourists, but they provide critical infrastructure protection for existing development and regional economic benefits.

- Mine Reclamation – There are numerous abandoned surface coal mines throughout the Commonwealth of Pennsylvania. Due to the extensive environmental damage caused by these mines, the USEPA has mandated that the Commonwealth of Pennsylvania close the mines and control acid leachate. One strategy for closure and remediation is through the use of processed dredged materials. NJMR recently funded a highly successful project demonstrating the effective use of dredged materials mixed with cement and ash to fill the old mines and restore the landscape to the original grade.